Article

Outcome of arthroscopic debridement of cartilage injury in the equine distal interphalangeal joint

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Abstract — The purpose of this study was to report long-term outcome following arthroscopic debridement of articular cartilage lesions of the distal interphalangeal joint, diagnosed with high-field magnetic resonance imaging. Diagnosis was based on the results of diagnostic anesthesia, magnetic resonance imaging (MRI), and arthroscopy. Ten horses underwent arthroscopic evaluation for cartilage injury and received various intra-articular therapies after surgery. Three of ten horses had lesions that were surgically inaccessible. Four horses became sound and returned to their preoperative level of athleticism, and 1 horse returned to performance with continued intermittent lameness. None of the horses with an inaccessible lesion achieved soundness. Duration of lameness before surgery, preoperative evidence of degenerative joint disease, and surgical accessibility of cartilage injury did not exhibit clear influence on outcome. As a primary cause of lameness, articular cartilage injury of the distal interphalangeal joint carries a guarded prognosis for soundness with surgical therapy.

Résumé — **Résultat d'un débridement arthroscopique d'une blessure du cartilage dans l'articulation interphalangienne distale.** Le but de cette étude consistait à signaler les résultats à long terme après un débridement arthroscopique des lésions du cartilage articulaire de l'articulation interphalangienne distale, diagnostiqués par résonance magnétique de haute résolution. Le diagnostic s'est fondé sur les résultats de l'anesthésie diagnostique, de l'image par résonance magnétique (IRM) et de l'arthroscopie. Dix chevaux ont subi une évaluation arthroscopique d'une blessure du cartilage et reçu diverses thérapies intra-articulaires après la chirurgie. Trois des dix chevaux avaient des lésions qui étaient inaccessibles par chirurgie. Quatre chevaux se sont rétablis et sont retournés à leur niveau préopératoire de constitution athlétique et un cheval est retourné à la performance avec une boiterie intermittente persistante. Aucun des chevaux avec une lésion inaccessible ne s'est rétabli. La durée de la boiterie avant la chirurgie, les signes préopératoires de maladie articulaire dégénérative et l'accessibilité chirurgicale d'une blessure du cartilage n'ont pas eu une influence claire sur les résultats. Comme cause principale de boiterie, la blessure du cartilage articulaire de l'articulation interphalangienne distale comporte un pronostic réservé pour le rétablissement avec une thérapie chirurgicale.

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Introduction

Lameness localized to the foot is a common source of performance limitation in horses (1,2). Previous studies have documented a variable, but guarded prognosis for soundness and return to athleticism with medical treatment of lameness responsive to diagnostic anesthesia of the distal interphalangeal (DIP) joint, with success rates of 30% (3) and 46% to 67% (4). This guarded prognosis may be in part associated with the inability to precisely localize and diagnose lesions with traditional imaging modalities. Other studies have reported medical therapy returning 65% of horses with effusion of the DIP joint (5) and up to 53% of horses with DIP joint effusion and synovial proliferation (6) on magnetic resonance imaging (MRI) to soundness. Expansion of the clinical use of MRI has allowed diagnosis of specific injuries within the equine foot, including partial and full thickness cartilage erosion in the DIP joint (7), and has allowed elucidation of therapeutic outcome for specific lesions (5,6,8). In a cadaver model, full thickness erosion of articular cartilage within the equine DIP joint has been detected on low-field MRI with a sensitivity of 90% to 100% and accuracy of 55% to 90%, whereas partial thickness lesions were only detectable with 35% to 80% sensitivity and 35% to 60% accuracy, with superficial erosions remaining undetectable (7). However, the sensitivity and accuracy of MRI for detection of articular cartilage erosion likely differ in a clinical setting as naturally occurring lesions may not be as large or

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ARTICLE

sharply demarcated. Distal interphalangeal articular cartilage injury, currently an uncommon primary etiology for lameness, has accounted for only 2.5% of cases localized to the foot (8,9). Despite the infrequency of occurrence, DIP cartilage erosion was invariably associated with a poor outcome (8).

Articular cartilage injury has long been associated with a reduced propensity to heal, as partial- or full-thickness cartilage lesions > 5 mm in diameter do not show spontaneous healing in horses (10). Currently in equine orthopedics, partial thickness cartilage erosions are commonly surgically treated with chondroplasty alone (10), but autologous chondrocyte implantation (ACI) has been used clinically in humans (11) and experimentally in horses to enhance hyaline cartilage repair (12). While enhancing healing scores in partial thickness lesions (12), ACI requires separate procedures for harvesting and implantation of chondrocytes, limiting its clinical application in horses. Full thickness cartilage lesions are commonly treated with debridement and microfracture in horses (10). However, the poor wear characteristics of the resultant fibrocartilage when compared to hyaline cartilage (13) has led to an increase in clinical use of cartilage implantation techniques such as ACI, osteochondral autograft transfer (OAT), osteochondral allograft transplantation (OCA), and particulate juvenile allograft cartilage (PJAC) in humans (11). Osteochondral autograft transfer has been evaluated experimentally (12,14) and clinically (15) in horses for treatment of subchondral cystic lesions (SCL) with success, but this therapy and ACI have limited clinical application to the equine DIP joint as they require arthrotomy for implantation. Outcome of arthroscopic debridement and lavage of cartilage defects has been reported for naturally occurring lesions of the medial femoral condyle and found to be successful in 7 of 9 (16) and 6 of 7 (17) cases of focal cartilage injury. To the authors' knowledge, surgical management of cartilage injury has not been reported in the DIP joint, with experimentally induced or naturally occurring lesions.

The objectives of this study were to i) report long-term outcome after surgical management of articular cartilage injury in the DIP joint of horses; and ii) to identify clinical factors that may affect post-operative outcome.

Materials and methods

Medical records of horses that underwent DIP arthroscopy for evaluation and treatment of articular cartilage injury between 2012 and 2017 at an equine surgical facility were reviewed. Patient signalment, pre- and post-operative lameness evaluations, radiographic studies, MRI studies, surgery reports, and arthroscopic images were obtained and reviewed. Only patients with lameness attributable to a primary articular cartilage lesion, with diagnosis based on response to diagnostic anesthesia, MRI, and arthroscopic appearance were included. Horses that underwent DIP arthroscopy for uncomplicated osteochondral fragment removal, distal phalangeal fracture repair, or subchondral cystic enucleation were excluded.

All horses were examined for lameness by CM or RH while trotting in hand in a straight line and right and left circles on an asphalt lameness pad. Lameness was graded on a 0 to 5 scale, in accordance with the American Association of Equine Practitioners (AAEP) grading system (AAEP 1991). Pre- and post-operative lameness grades, response to diagnostic anesthesia, and the administration of/response to prior intra-articular medications were recorded when available.

Radiographic images and reports were also reviewed, and evidence of degenerative joint disease (DJD) or other lesions were recorded. Horses with radiographic findings other than evidence of DJD were excluded from analysis. Magnetic resonance imaging was performed at a referral imaging center, and all studies were performed with a wide-bore gantry, Siemens Verio 3.0 Tesla MRI system (Siemens Medical Solutions, Malvern, Pennsylvania, USA), with patients under general anesthesia in lateral recumbency. In all cases, MR images were obtained in the transverse, sagittal, and dorsal planes using T1-weighted, T2-weighted, gradient echo (GRE), and short *tau* inversion recovery (STIR) sequences. Studies were interpreted by a Board-certified radiologist and Board-certified surgeon experienced in MRI interpretation (CM). Magnetic resonance imaging reports and images were reviewed, and the location and character of cartilage injury, presence of increased fluid signal within or loss of subchondral bone underlying cartilage erosion, evidence of DJD, and other concurrent lesions other than DIP cartilage injury were recorded. Radiographic evidence of DJD was considered to include periarticular osteophytosis, sclerosis of the subchondral bone plates of the distal phalanx or distal articular surface of the middle phalanx, subchondral bone lysis, or prominent enthesopathy of the areas of joint capsular attachment of the DIP joint. Magnetic resonance imaging evidence of DJD was considered to include periarticular osteophytosis, capsular thickening, hypointense areas of subchondral bone on T1-weighted images, or enthesopathy at areas of joint capsular attachment of the DIP joint.

Surgical technique

All patients were administered phenylbutazone (Equi-Phar; Sparhawk Laboratories, Lenexa, Kansas, USA), 2.2 mg/kg body weight (BW), IV, before surgery, and 1.1 mg/kg BW, PO, q12h for 5 d after surgery. Peri-operative antimicrobial prophylaxis was used in all cases, with cefazolin (Cefazolin; West-Ward Pharmaceutical, Eatontown, New Jersey, USA), 11 mg/kg BW, IV, and gentamicin (Gentaved 100; Sparhawk Laboratories), 6.6 mg/kg BW, IV, administered 30 to 45 min before skin incision. Antibiotic administration was limited to peri-operative use and was not continued in the post-operative period. Patients were premedicated with xylazine (Anased 100 mg/mL; Akorn, Lake Forest, Illinois, USA), 1 mg/kg BW, IV, and butorphanol (Dolorex 10 mg/mL; Merck, Madison, New Jersey, USA), 0.02 mg/kg BW, IV, and anesthetized with ketamine (Ketaset 100 mg/mL; Zoetis, Kalamazoo, Michigan, USA), 2 mg/kg BW, IV, and midazolam (Midazolam 5 mg/mL; Akorn). All horses were intubated with an appropriately sized, cuffed endotracheal tube, and a surgical plane of anesthesia was maintained with sevoflurane (Sevoflo; Abbott Laboratories, North Chicago, Illinois, USA), administered in 100% oxygen in a semi-closed circle system with mechanical ventilation.

All horses were positioned in dorsal recumbency or lateral recumbency with the limb to be operated uppermost, dependent on surgeon preference, on a padded surgery table. When placed in dorsal recumbency, the digit of the limb to be operated was fixed in extension. In lateral recumbency, stabilization was limited to the metacarpus. Prior to induction of anesthesia, hair from the fetlock distally was clipped, and the outer corium of the hoof was removed with a rasp. The sole of the hoof was covered with a latex examination glove and sealed with superglue at a point approximately 2 cm distal to the coronary band. Routine aseptic preparation of the surgical site was performed with povidone-iodine scrub and isopropyl alcohol, and the dorsal half of the circumference of the coronary band was isolated with standard draping technique, utilizing adhesive incise drapes (Ioban 2; 3M, St. Paul, Minnesota, USA).

A standard arthroscopic approach was used in all cases to access the dorsal compartment of the DIP joint (18). A 4-mm, 30-degree forward viewing arthroscope was used in all procedures. Cartilage lesions were visualized when accessible, and all areas of incompletely attached cartilage were removed with Ferris-Smith rongeurs or a motorized synovial resector. Visible full-thickness cartilage lesions were debrided to a level of bleeding, firm subchondral bone, removing the remaining calcified cartilage layer to the margin of the defect. Debridement was achieved using curettage or a motorized burr. Fibrillation of partial thickness lesions was removed with a motorized resector, but partial thickness lesions were not debrided beyond removal of fibrillation. Following debridement, all joints were lavaged with sterile polyionic fluids. Arthroscopic portals were closed with 2 to 3 simple interrupted sutures, purchasing the cutaneous layer only, of 2-0 polypropylene monofilament suture swaged on a 3/8 circle, 26 mm reverse cutting needle (Prolene; Ethicon, Somerville, New Jersey, USA). A sterile bandage was applied; the patient was moved to a padded recovery room and allowed to recover unassisted.

The estimated size, depth, and location of the cartilage lesion were recorded. Location was determined by arthroscopy if accessible, and by MRI when arthroscopically inaccessible. To clearly categorize lesion location, the articular surface of the DIP joint was divided into thirds by lines in the sagittal plane dividing the joint into medial abaxial, central, and lateral abaxial portions. Dorsopalmar lesion location was categorized as dorsal or palmar by a line bisecting the articular surface in the frontal plane from medial to lateral (7).

Post-operative management

Sutures were removed 12 d after surgery, and arthroscopic portals were bandaged for 14 d. After surgery, patients were confined to box stalls for 2 mo under a regimen of controlled exercise. This regimen consisted of handwalking 5 min daily, beginning 14 d after surgery, increasing by 5 min per wk. Thereafter, patients were paddock-confined for 30 d. Clinical examinations were repeated at 3 and 4 mo after surgery, or as needed based on degree of lameness or regimen of post-operative intra-articular therapy. If patients were sound at 3 mo, a slow increase in exercise under saddle "walk-trot" was permitted for the last 30 d, with patients returning to work 4 mo after surgery if determined to be sound. Continued controlled exercise was implemented when persistent lameness was noted beyond the fourth post-operative month.

Post-operative intra-articular therapeutic regimens were elected based on surgeon preference, individual clinical features related to each case, and client financial constraints. Horses received 1 or more of the following alone, in combination, or in sequence: intra-articular administration of bone marrow-derived, cultured mesenchymal stem cells; platelet-rich plasma (Arthrex ACP; Naples, Florida, USA); autologous conditioned serum (Orthokine, Dusseldorf, Germany); hyaluronic acid (Hyvisc; Boehringer Ingelheim Vetmedica, St. Joseph, Missouri, USA); or triamcinolone acetonide (Kenalog-10, Bristol Myers Squibb, Princeton, New Jersey, USA). When mesenchymal stem cells were administered, 20 million culture-expanded cells were administered intra-articularly in 22 mg hyaluronic acid every 30 d for 3 treatments, beginning 30 d after surgery. Autologous conditioned serum was administered every 10 d for 3 treatments, beginning 30 d after surgery.

Patients were only included if there was a minimum of 6 mo for post-operative follow-up. Details about the horse's current level of use and soundness were obtained by telephone interview with owners or trainers. A successful outcome was defined as post-operative return to previous level of activity and soundness. Horses that required palmar digital neurectomy (PDN) to return to previous activity level or soundness were not considered successful. Descriptive statistics are presented for continuous and ordinal variables (duration of lameness/lameness grade), and all statistics were generated using Microsoft Excel (2016).

Results

Ten horses met the criteria for inclusion in the study. No complications associated with anesthesia or surgery were encountered with any horse. Signalment, occupation, the location of cartilage injury, and other lesions noted on MRI are summarized in Tables 1 and 2. Clinical examination history, response to diagnostic anesthesia, and radiographic imaging findings were available for 9 of 10 horses. No pre-operative information was available for case 4, as examination was performed by the referring veterinarian and was not available. The left forelimb was affected in 3 horses, and the right forelimb in 7 horses. Duration of lameness before surgery ranged from 5 to 970 d (median: 210 d), with a median lameness duration of 165 d for successful cases, and 215 d for failures. Lameness grades pre-surgery ranged from 1 to 3 (median: 2); horses with a successful outcome had a median pre-operative lameness grade of 2.5, and those with an unsuccessful outcome had a median pre-operative lameness grade of 2. In all pre-operative examinations, diagnostic anesthesia of the DIP joint significantly improved lameness to a degree considered confirmatory for the origin of the lameness by the examining clinician. All horses for whom history was available had experienced a recurrence of lameness after prior treatment with an intra-articular anti-inflammatory drug and controlled exercise (Table 3). Pre-operative radiographic evidence of DJD was present in 1 horse (case 7) (periarticular osteophytosis at the dorsal/palmar condyle of P2), and MR evidence of DJD was evident in 3 horses (cases 1, 7, 4).

Follow-up was available for all horses, and ranged from 10 mo to 3 y post-surgery. Four horses became sound and returned to their previous level of activity (cases 3, 8, 9, 10). One horse

Table 1. Nominal variables for unsuccessful cases.

Case	Signalment/Use	Lesion location	Diameter/Depth	Other MRI lesion	Outcome
1	8 y Warmblood gelding/Jumping	Lateral 1/3/Dorsal P3-I	~1 cm, focal; FT	Mild ISL desmopathy	Retired (lameness)
2	14 y Quarter Horse gelding/Team roping	Central 1/3/Dorsal P3-A	~1.3–1.5 cm, focal; FT	Mild Nb degeneration	PDN 6 mo post-op/EU (lameness)
4	14 y Quarter Horse gelding/Barrel racing	Central 1/3/Dorsal P3-A	~10% dorsal articular surface; FT/PT	Mild Nb degeneration	PDN 4 mo post-op/EU (lameness)
5	7 y Quarter Horse gelding/Team roping	Central 1/3/Dorsal P3-A Central 1/3/Central P2-I	~1 cm lesions (2); FT	STIR hyperintensity in medial Nb	PDN 8 mo post-op/ Sound in work
6	7 y Quarter Horse gelding/Barrel racing	Central-lateral 1/3/ Central P3-I	~1 cm, focal; FT	EPF/Nb degeneration	Retired (lameness)
7	15 y Thoroughbred gelding/3-Day eventing	Central 1/3/Dorsal P3-A	~1 cm, focal; FT, diffuse fibrillation	EPF/mild navicular bursitis	In work with intermittent lameness, 15 mo post-op

PDN — palmar digital neurectomy; I — inaccessible; A — accessible; FT — full thickness; PT — partial thickness; ISL — intersesamoidean ligament; Nb — navicular bone; EU — euthanized; EPF — extensor process fragmentation.

Table 2. Nominal variables for successful cases.

Case	Signalment/Use	Lesion location	Diameter/Depth	Other MRI lesion	Outcome
3	5 y Quarter Horse gelding/Barrel racing	Central 1/3/Dorsal P3-A	1.75 cm, linear defect; FT	Mild STIR hyperintensity in Nb	Sound/in work 9 mo post-op; EU (laminitis)
8	12 y Holsteiner mare/ Jumping	Central 1/3/Dorsal P3-A	~1 cm, focal; FT	Moderate proliferative navicular bursitis	Sound in work, 10 mo post-op
9	3 y Quarter Horse stallion/Racing	Central 1/3/Dorsal P3-A	~1 cm, focal; FT	LF-SCL P3 RF-Cartilage lesion	Sound, raced 19 mo post-op, now at stud
10	5 y Dutch Warmblood gelding/Dressage	Central 1/3/Dorsal P3-A	~1 cm, focal; FT	None	Sound in work, 5 y post-op

SCL — subchondral cystic lesion; A — accessible; FT — full thickness; Nb — navicular bone; EU — euthanized.

(case 7) experienced continued intermittent lameness (1/5) post-surgery, but successfully returned to his previous level of eventing. Subchondral bone abnormality in association with cartilage injury was present in 3 horses on MRI. None of these horses achieved soundness or returned to work. Cartilage lesions were detectable in proton dense (PD), dual echo (DE), and STIR sequences obtained in the dorsal, sagittal, and transverse planes in all cases. All full-thickness cartilage lesions were detected on MRI, but only completely surgically accessible in 7 of 10 horses. Partial thickness lesions were detected arthroscopically in 2 horses (cases 4, 7), but neither was visible on MRI before surgery. Cartilage lesions were arthroscopically accessible in all horses that successfully returned to athleticism. Three horses had lesions that were completely inaccessible (cases 1, 6) or incompletely accessible (case 5) surgically. All horses with completely inaccessible lesions experienced continued lameness and were retired within 1 y after surgery. The location of the cartilage injury in case 5 was only partially surgically accessible and was considered "inaccessible" for statistical purposes. However, the visible (distal phalangeal) lesions were debrided to the extent of visibility. This horse experienced a progressive, post-operative increase in lameness, and after palmar digital neurectomy, successfully returned to athleticism. Three of 5 horses that experienced continued lameness underwent palmar digital neurectomy 5, 6, and 10 mo post-surgery. Two of these horses were euthanized due to continued lameness and severe rapid progression of osteoarthritis at 5 and 6 mo after neurectomy.

After surgery, 3 horses were treated with bone marrow-derived, culture-expanded mesenchymal stem cells, and of these, 1 horse became sound and returned to work. Autologous conditioned serum and platelet rich plasma were each used in 3 cases, and only 1 horse from each of these 2 groups returned to work soundly. Two horses received polysulfonated glycosaminoglycan intra-articularly and both met the criteria for success. One horse was treated with intra-articular triamcinolone and hyaluronan once post-surgery, and did not return to soundness and athleticism. Post-operative therapies are detailed in Table 3.

Discussion

These results suggest a guarded prognosis for articular cartilage injuries of the DIP joint treated surgically after failing to respond to intra-articular anti-inflammatory therapy. Only lesions within the dorsal 1/2 of the central 1/3 of the articular surface of P3 were accessible for debridement. The dorsal 1/2 of the distal condylar surface of P2 was reliably visible in all cases, with the conventional dorsal approach (18). Palmar/plantar (19) and lateral/medial (20) approaches to the palmar/plantar compartment of the DIP joint have been described and evaluated for intra-articular anatomy, accessibility, and inadvertent penetration of other synovial structures. These approaches were not used in this study as inaccessible cartilage lesions were most commonly located in an area of P3 that exceeded the lateral or medial limits of accessibility or were located too palmar on the articular surface of P3 (Table 1) to allow visualization.

Table 3. Pre- and post-operative therapies and outcome.

Case	Preoperative treatment	Postoperative treatment	Outcome
1	IA HA/TA in DIPJ/NB	IA HA/TA in DIPJ	Fail
2	IA HA/TA in DIPJ/NB	IA PRP/ACS	Fail
3	IA HA/TA in DIPJ/NB	IA BM-MSC	Success
4	Unknown	IA BM-MSC	Fail
5	IA HA/TA in DIPJ/NB	IA BM-MSC	Fail
6	IA HA/TA in DIPJ	IA PRP/Stanozolol	Fail
7	Multiple (eight) IA HA/TA in DIPJ/NB (one); IA Stanozolol DIPJ (three)	IA ACS	Fail
8	IA HA/TA in DIPJ/NB; IA Stanozolol in DIPJ	IA PRP/ACS	Success
9	IA HA/TA in DIPJ (two)	IA HA/PSGAG	Success
10	IA HA/TA in DIPJ	IA PSGAG	Success

TA — triamcinolone acetonide; NB — navicular bursa; PRP — platelet-rich plasma; ACS — autologous conditioned serum; BM-MSC — bone marrow derived mesenchymal stem cells; PSGAG — polysulfonated glycosaminoglycan; HA — hyaluronic acid; DIPJ — distal interphalangeal joint.

Only a limited and variable degree of visibility of the palmar/plantar articular surface of P3 is afforded by a palmar/plantar approach (19). This limitation to evaluation of the palmar/plantar compartment is consistent with the authors' experience, and these approaches were not attempted in this study population. However, horses with a palmar/plantar lesion on the articular surface of P2 (Case 5) could benefit from evaluation of the palmar compartment if the lesion was located sufficiently palmar on the condyle to allow debridement. Although no inferential statistical analysis could be performed due to the small sample size, there is likely an association of undetermined significance between location and outcome in this study, in that all horses with inaccessible lesions remained lame or required palmar digital neurectomy to return to work. Further evaluation of this potential association is warranted in a larger sample size to allow proper evaluation of the influence of lesion location on outcome. Low power, due to the low case numbers, coupled with no comparable control population, represent the major limitations to this study, along with its retrospective nature. Additionally, post-operative therapies differed in these cases based on surgeon preference (Table 3). The variation in treatment represents another potential confounding influence on outcome, making interpretation of the sole impact of surgical therapy difficult.

The 40% of horses in which surgical treatment was successful all had in common a focal area of cartilage injury in a location conducive to complete debridement and were free from evidence of DJD before surgery. This group of horses may represent a separate clinical syndrome than the other 60%. While duration of lameness was no different for this subset of horses than the rest, the features surrounding the nature of their solitary cartilaginous injuries suggest a more acute traumatic etiology, rather than a degenerative or erosive one subsequent to osteoarthritis or a chronic inflammatory response. This is supported by the observation that these 4 horses had no MRI or radiographic evidence of capsular thickening or established osteoarthritis. Careful pre-operative evaluation for evidence of DJD is recommended in cases involving the DIP joint, based on its negative effect on prognosis in this study population. This association supports the findings of Kristiansen and Kold (4) of a more guarded prognosis with radiographic change to the extensor process of P3. Horses for which pre-operative data were available (all but case 4), all had lameness localized to intra-articular DIP joint anesthesia. Intra-articular anesthesia of the DIP joint has been shown to alleviate solar pain as well as pain associated with the navicular bursa, which reduces the specificity of response to intra-articular anesthesia in the identification of cases of DIP lameness (21,22).

The coexistence of other pathology within the podotrochlear apparatus of many horses represents another limitation of this study. While the combination of response to diagnostic anesthesia together with the appearance on MRI and at surgery are strong indicators of the origin of pain in the authors' opinion, the presence of multiple lesions to the podotrochlear apparatus may have a negative effect on prognosis that was not captured in the present study. Because 8/10 cases had multiple lesions on MRI, the confounding effects of these lesions may have worsened the prognosis for surgical management of solitary cartilage lesions in this study. These other lesions were classified as mild and not considered to be associated with the primary lameness at the time of diagnosis; however, the influence of these lesions in the rehabilitation period is unknown. Multiple lesions are commonly present on MRI evaluation of lameness localized to the foot, and commonly present a diagnostic and therapeutic challenge (8).

The guarded rate of return to performance noted in the horses of this report suggests that the risks of surgery and general anesthesia, as well as the financial costs, should be weighed against the outcome. Accessible lesions were treated with chondroplasty of partial thickness defects, and debridement and

ARTICLE

lavage of full thickness defects in this study. However, alternate surgical therapies may offer an improvement in cartilage healing and return to soundness. Subchondral bone microfracture has been shown to promote a greater volume of repair tissue and an increased percentage of type II collagen in treated experimental defects of the radial carpal bone and medial femoral condyle (23). Further investigation of microfracture and other cartilage-promoting therapies may be warranted in the DIP joint to improve prognosis, although no effect on clinical outcome could be found when microfracture was used in cartilage lesions of the stifle (24).

In conclusion, based on these findings, horses with lameness attributable to cartilage injury in the DIP joint, that have failed to respond to intra-articular medication, have a guarded prognosis for return to performance. However, the authors speculate that horses with arthroscopically accessible, acute cartilage injury of the DIP joint without evidence of DJD, have an improved prognosis for return to performance following surgery. The sole influence of surgical debridement of these lesions on outcome could not be precisely measured in the current study with the limitations discussed, and additional evidence is required to confirm such clinical suspicion. CVJ

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